Claims

1. A method for manufacturing a first photonic device optically connected to a second photonic device, comprising the steps:

a) epitaxially growing a first set of layers, including at least a first waveguide layer, on a semiconductor material having a dopant of a first type,

b) applying an island mask on top of the first set of layers and removing the first set of layers in the unmasked areas,

c) epitaxially growing a second set of layers for the second photonic device, including at least a second waveguide layer, on the semiconductor material in the unmasked areas, and thereafter removing the island mask,

d) applying a first mask on top of the grown layers, removing the first and the second sets of layers in the unmasked areas, to form at least said first photonic device in a mesa structure and a second photonic device region coupled to said first photonic device in a light transmission direction, and removing the first mask,

e) epitaxially growing a cladding layer at least on top of the first set of layers and the second set of layers, said cladding layer having a dopant of a second type, opposite to said first type,

f) epitaxially growing a contact layer on top of the cladding layer, and

g) arranging a first and a second metal contact, being separated, on top of the contact layer, said first metal contact being arranged above said first set of layers and said second metal contact being arranged above said second set of layers,

characterized in that the forming of the first photonic device into a mesa structure include using the first mask to form a mesa structure without an adjacently arranged second set of layers other than in the light transmission direction, and the method comprises the additional steps prior to step g):

f1) applying a second mask on the contact layer, covering at least a part of said first set of layers and at least a part of said second set of layers,

f2) etching the contact layer and at least a part of the cladding layer, in the unmasked areas, and

f3) applying an insulating material in the areas not covered with the second mask.

2. The method according to claim 1, wherein the method further comprises the additional steps prior to step e):

d1) epitaxially growing a thin layer having a dopant of the second type on and around the first set of layers and the second set of layers, and

d2) epitaxially growing an etch stop layer on top of the thin layer grown in step d1),

whereby the etching in step f2) is stopped by the etch stop layer grown in step d2).

3. The method according to any of claims 1-2, wherein said semiconductor material is an epitaxially grown layer on top of a substrate.

4. The method according to claim 3, wherein said substrate is a semi-insulating substrate, or a semiconductor substrate having a dopant of the first or the second type.

5. The method according to any of claims 1-4, wherein said semiconductor material is a semiconductor substrate.

6. The method according to any of claims 1-5, wherein said first photonic device is selected to be any of the group: laser, detector and amplifier.

7. The method according to any of claims 1-6, wherein said second photonic device is selected to be a modulator.

8. The method according to any of claims 1-7, wherein the second mask is a metal mask, preferably made from Titanium.

9. The method according to any of claims 1-8, wherein said insulating material is selected to be a planarizable material, preferably a polymer.

10. The method according to any of claims 1-9, wherein said forming of the first photonic device into a mesa structure including the use of the first mask to form a mesa structure without an adjacently arranged second set of layers other than in the light transmission direction also include removing some of the first set of layers .

11. The method according to any of claims 1-10, wherein the method comprises the additional steps of:

- modifying step d) to include using the first mask to remove said second set of layers in an area adjacent to the second photonic device, to form a window region in the light transmission direction of said first and second photonic device, and
- modifying step e) to include growing the cladding layer in the window region.

12. The method according to claim 11, wherein the width of the part of said second mask used for masking said window region is larger further from the second set of layers

compared to the width of the part closest to the second set of layers.

13. The method according to claim 12, wherein said window region masking part is selected to have a tapered shape.

14. A device including a first photonic device optically connected to a second photonic device comprising:

- a first set of epitaxially grown layers, including at least a first waveguide layer, formed in a mesa structure on top of a semiconductor material having a dopant of a first type,
- a second set of epitaxially grown layers, including at least a second waveguide layer, formed in a second photonic device region being coupled to said first photonic device in a light transmission direction, on top of the semiconductor material,
- a cladding layer having a dopant of a second type, opposite to said first type, arranged on top of the mesa structure, the second photonic device region and the surrounding semiconductor material,
- a contact layer arranged on top of the cladding layer, and
- a first and a second metal contact, separately arranged on top of the contact layer, said first metal contact being arranged above said first set of layers and said second metal contact being arranged above said second set of layers,

characterized in that said first set of layers is shaped into a mesa structure in an etching process to remove any adjacent arranged second set of layers in the non-light transmission direction, and said cladding and contact layers are shaped in an etching process to have a first contact mesa

structure at least above the mesa structure and a second contact mesa structure at least above the second photonic device region, the device further comprising:

- an insulating material applied around the not etched cladding and contact layer.

15. The device according to claim 14, wherein a thin layer having a dopant of the second type is arranged on and around the mesa structure and the second photonic device region, and an etch stop layer is arranged on top of the thin layer, whereby the etching of the cladding and contact layer, to shape the first contact mesa structure and the second contact mesa structure, is stopped by the etch stop layer.

16. The device according to any of claims 14-15, wherein said first photonic device is any of the group: laser, detector and amplifier.

17. The device according to any of claims 14-16, wherein said second photonic device is a modulator.

18. The device according to any of claims 14-17, wherein said semiconductor material is an epitaxially grown layer on top of a substrate.

19. The device according to claim 18, wherein said substrate is a semi-insulating substrate, or a semiconductor substrate having a dopant of the first or the second type.

20. The device according to any of claims 14-19, wherein said semiconductor material is a semiconductor substrate.

21. The device according to any of claims 14-20, wherein a window region is provided in the cladding layer arranged

adjacent to said second contact mesa structure in the light transmission direction.

22. The device according to claim 21, wherein the width of said window region is larger further from the second contact mesa structure compared to the width of the part closest to the second contact mesa structure.

23. The device according to any of claims 14-22, wherein the first set of layers is shaped into a mesa structure by also removing some of the first set of layers in the non-light transmission direction.